PRACTICE EXAM 25: PE CIVIL - STRUCTURAL SIMULATION (100 QUESTIONS)

This expanded practice exam contains 100 four-option questions weighted to the NCEES PE Civil: Structural specification effective before April 2027. The actual PE Civil exam contains 80 questions and provides 8 hours of exam time within a 9-hour appointment. To preserve the official six-minute-per-question pace, allow 10 hours for this 100-question simulation. Use the NCEES PE Civil Reference Handbook and the design standards listed for the applicable Civil: Structural exam. NCEES reports results as pass/fail and does not publish a fixed passing percentage.

1. A simply supported floor beam has a tributary width of 10 ft and supports a uniform floor load of 92 psf. What uniform line load acts on the beam?

A. 92 lb/ft
B. 920 lb/ft
C. 460 lb/ft
D. 1,840 lb/ft

2. A 24-ft simply supported beam carries a uniform service load of 2.2 kip/ft over its full span. What is the vertical reaction at each support?

A. 26.4 kip
B. 13.2 kip
C. 52.8 kip
D. 4.4 kip

3. A concrete slab is 6 in. thick and has a unit weight of 150 pcf. What is the slab self-weight expressed as a uniform pressure?

A. 112.5 psf

B. 56.25 psf
C. 75 psf
D. 900 psf

4. For this practice check, use the load combination U = 1.2D + 1.6L. If D = 42 psf and L = 60 psf, what is U?

A. 101.7 psf
B. 113.9 psf
C. 162.7 psf
D. 146.4 psf

5. A roof snow calculation is defined for this problem by p = 0.7 Ce Ct Is pg. If Ce = 0.95, Ct = 1.0, Is = 1.0, and pg = 40 psf, what is p?

A. 29.6 psf
B. 26.6 psf
C. 38.0 psf
D. 24.0 psf

6. For this practice check, compute velocity pressure from q = 0.00256 Kz Kzt Kd V^2 I. Use Kz = 0.85, Kzt = 1.0, Kd = 0.85, V = 128 mph, and I = 1.0. What is q?

A. 30.3 psf
B. 35.7 psf
C. 25.7 psf
D. 42.1 psf

7. A seismic base shear is defined for this problem as V = CsW. If Cs = 0.085 and the effective seismic weight W = 2,600 kip, what is V?

A. 30.66 kip
B. 203.7 kip
C. 260 kip
D. 221 kip

8. A uniform surcharge of 540 psf acts behind a 12-ft retaining wall. If the lateral pressure coefficient is Ka = 0.33, what lateral force per foot of wall results from the surcharge alone?

A. 178.2 lb/ft
B. 1,069.2 lb/ft
C. 2,138.4 lb/ft
D. 6,480 lb/ft

9. Soil behind a retaining wall has unit weight 120 pcf, active coefficient Ka = 0.30, and retained height 14 ft. What is the resultant active soil force per foot of wall, using Pa = 0.5 Ka gamma H^2?

A. 7,056 lb/ft
B. 4,704 lb/ft
C. 235.2 lb/ft
D. 3,528 lb/ft

10. A 33-kip truck axle is located 8 ft from the left support of a 24-ft simply supported bridge span. What is the left support reaction due to that axle?

A. 11 kip
B. 24.20 kip
C. 22 kip
D. 33 kip

11. A girder supports floor beams spaced at 12 ft. Each floor beam delivers a 42-kip end reaction to the girder. If that reaction is idealized as an equivalent uniform line load, what line load represents the beam reactions?

A. 3.50 kip/ft
B. 504 kip/ft
C. 1.75 kip/ft
D. 7 kip/ft

12. A steel deck weighs 3 psf and supports 5 in. of normal-weight concrete at 145 pcf. What combined dead-load pressure is carried before adding other permanent loads?

A. 59.7 psf
B. 63.4 psf
C. 182.9 psf
D. 720.5 psf

13. For this practice check, a reduced live load is defined as L = L0(0.25 + 15/sqrt(KLLAT)). If L0 = 80 psf and KLLAT = 3,600 ft2, what is L?

A. 18 psf
B. 40 psf
C. 62 psf
D. 29 psf

14. A roof contains 6.5 in. of ponded rainwater. Using a water unit weight of 62.4 pcf, what uniform roof pressure does the water create?

A. 405.6 psf
B. 81.1 psf
C. 33.8 psf
D. 16.9 psf

15. A crane wheel load of 56 kip is increased by a stated impact factor of 25%. What design wheel load results for this problem?

A. 56 kip
B. 14 kip
C. 84 kip
D. 70 kip

16. Two identical roof girders share a total vertical gravity load of 210 kip equally. One girder also receives a 24-kip concentrated equipment load that is not shared. What total gravity load acts on that girder?

A. 129 kip
B. 101.8 kip
C. 115.4 kip
D. 230.8 kip

17. A member is checked using three stated load combinations: 1.4D; 1.2D + 1.6L; and 1.2D + 1.0W + 1.0L. If D = 30 kip, L = 55 kip, and W = 40 kip, what is the largest resulting factored load?

A. 131 kip
B. 43.67 kip
C. 120.6 kip
D. 135.2 kip

18. A simply supported 20-ft beam carries a 18-kip point load at midspan. What is the maximum bending moment?

A. 180 kip-ft
B. 45 kip-ft
C. 360 kip-ft
D. 90 kip-ft

19. A simply supported 18-ft beam carries 2.3 kip/ft uniformly over the span. What is the maximum bending moment?

A. 41.40 kip-ft
B. 186.3 kip-ft
C. 93.15 kip-ft
D. 82.80 kip-ft

20. A 16-ft simply supported beam carries a 3 kip/ft uniform load over the full span. What is the magnitude of the shear reaction at either support?

A. 48 kip
B. 24 kip
C. 12 kip
D. 6.86 kip

21. A tension member carries 132 kip through a gross area of 6.0 in2. What average axial stress is produced?

A. 792 ksi
B. 0.0550 ksi
C. 22 ksi
D. 66 ksi

22. A 12-ft steel bar carries 72 kip in tension. Use A = 3.0 in2 and E = 29,000 ksi. What elongation results from delta = PL/(AE)?

A. 0.1192 in.
B. 0.0100 in.
C. 0.2384 in.
D. 0.0597 in.

23. A rectangular beam section has b = 10 in. and h = 21 in. What is its elastic section modulus S = bh^2/6 about the strong axis?

A. 6,615 in3
B. 735 in3
C. 367.5 in3
D. 13,230 in3

24. A beam has maximum moment M = 108 kip-ft and section modulus S = 600 in3. What maximum bending stress magnitude is produced?

A. 0.2 ksi
B. 22.0 ksi
C. 183.3 ksi
D. 2.2 ksi

25. A simply supported beam with a centered point load has P = 12 kip, L = 16 ft, E = 29,000 ksi, and I = 2,000 in4. Using delta = PL^3/(48EI), what midspan deflection is obtained?

A. 0.015 in.
B. 0.372 in.
C. 0.062 in.
D. 0.031 in.

26. A simply supported beam carries w = 0.18 kip/in. over a 120-in. span. If E = 29,000 ksi and I = 1,500 in4, use delta = 5wL^4/(384EI). What is the maximum deflection?

A. 0.0023 in.
B. 0.0224 in.
C. 0.0112 in.
D. 0.1120 in.

27. A pin-ended column has E = 29,000 ksi, I = 920 in4, and length L = 15 ft. Using Pcr = pi^2EI/L^2, what Euler critical load is obtained?

A. 8,127 kip
B. 4,064 kip
C. 16,254 kip
D. 677 kip

28. A solid circular shaft has torque T = 145 kip-in., radius c = 2 in., and polar moment J = 25.13 in4. Using tau = Tc/J, what maximum torsional shear stress results?

A. 5.78 ksi
B. 11.54 ksi
C. 23.08 ksi
D. 72.87 ksi

29. A column section has axial stress P/A = 6 ksi and bending stress magnitude Mc/I = 12 ksi at an extreme fiber. What is the maximum compressive stress when the effects add?

A. 18 ksi
B. 4.50 ksi
C. 11.25 ksi
D. 67.50 ksi

30. At a point in plane stress, sigma_x = 22 ksi, sigma_y = 4 ksi, and tau_xy = 6 ksi. Using sigma_1 = (sx+sy)/2 + sqrt(((sx-sy)/2)^2 + tau^2), what is the major principal stress?

A. 13.0 ksi
B. 23.8 ksi
C. 17.3 ksi
D. 28.1 ksi

31. A 36-ft steel member experiences a uniform temperature increase of 60 F. Using alpha = 6.5e-6/F, what free thermal elongation occurs?

A. 0.0140 in.
B. 1.6850 in.
C. 0.1685 in.
D. 0.0843 in.

32. A fully restrained steel bar experiences a 58 F temperature increase. Use E = 29,000 ksi and alpha = 6.5e-6/F. What thermal stress magnitude is produced from sigma = E alpha DeltaT?

A. 21.85 ksi
B. 0.38 ksi
C. 5.46 ksi
D. 10.93 ksi

33. A cantilever beam carries an end load P = 11 kip over a length L = 6 ft. What is the fixed-end moment magnitude?

A. 33 kip-ft
B. 66 kip-ft
C. 11 kip-ft
D. 396 kip-ft

34. A cantilever has w = 0.12 kip/in., L = 96 in., E = 29,000 ksi, and I = 1,200 in4. Using delta = wL^4/(8EI), what free-end deflection results?

A. 0.0732 in.
B. 0.0046 in.
C. 0.0366 in.
D. 0.2925 in.

35. At an unloaded joint of an ideal pin-connected truss, exactly two members meet and the two members are not collinear. No support reaction acts at the joint. What follows from joint equilibrium?

A. Both carry equal tensile force.
B. Both carry equal compressive force.
C. Only the steeper member is zero-force.
D. Both are zero-force members.

36. Which of the following idealized planar systems requires compatibility or deformation information in addition to the three equations of static equilibrium to determine all support reactions?

A. A fixed-fixed beam under transverse loading.
B. A simply supported beam with one pin and one roller.
C. A three-member triangular pin-jointed truss with proper supports.
D. A cantilever beam fixed at one end and free at the other.

37. For a simply supported 30-ft span, the influence-line ordinate for the left reaction at a load position 9 ft from the left support is (L-x)/L. What reaction is caused by a 24-kip moving point load at that location?

A. 7.20 kip
B. 24 kip
C. 16.80 kip
D. 14.40 kip

38. A detail experiences stress cycling between +21 ksi and -6 ksi. What is the stress range?

A. 13.50 ksi
B. 27 ksi
C. 6.75 ksi
D. 20.25 ksi

39. A 3/4-in.-diameter bolt bears on a 1/2-in.-thick plate under a 18-kip force. Using average bearing stress fb = P/(td), what stress is produced?

A. 48 ksi
B. 24 ksi
C. 36 ksi
D. 63.96 ksi

40. A rectangular column has area A = 20 in2, section modulus S = 80 in3, axial load P = 126 kip, and eccentricity e = 4 in. What maximum compressive stress is produced by P/A + Pe/S?

A. 6.30 ksi
B. 18.90 ksi
C. 31.50 ksi
D. 12.60 ksi

41. A rectangular beam has b = 12 in. and h = 22 in. What is its centroidal moment of inertia I = bh^3/12 about the strong axis?

A. 5,324 in4
B. 10,648 in4
C. 887.3 in4
D. 21,296 in4

42. A multistory concrete building is being cycled through floor pours. Why are reshores commonly retained beneath a recently cast slab after the original shores are removed?

A. To permanently replace the building's designed columns.
B. To eliminate the need to evaluate construction sequencing.
C. To increase concrete compressive strength by mechanical confinement.
D. To transfer construction loads through multiple levels while younger slabs gain adequate strength.

43. Fresh concrete exerts an idealized uniform lateral pressure of 840 psf on a 10-ft-long form panel that is 4 ft high. What total lateral force acts on the panel?

A. 8,400 lb
B. 2,100 lb
C. 33,600 lb
D. 840 lb

44. Before a temporary scaffold platform is released for use, which engineering action most directly addresses the structural loading risk from workers, tools, access, and stored materials?

A. Verify the scaffold configuration and load capacity for the intended workers, tools, materials, and access conditions.
B. Assume any erected scaffold can carry the same load as the permanent floor.
C. Load the platform first and inspect it only if noticeable deflection occurs.
D. Ignore material storage because only worker weight is relevant to scaffold loading.

45. A project specification calls for special inspection of selected structural work. Which description best captures the inspector's intended function?

A. Replace the contractor's responsibility for means and methods.
B. Authorize undocumented field changes whenever construction is delayed.
C. Observe or test specified work and document whether it conforms to approved requirements.
D. Guarantee that every completed structural element has zero defects.

46. A deep excavation will be made immediately beside an occupied building supported on shallow footings. Which preconstruction action best addresses the structural interaction risk?

A. Excavate to final depth first, then decide whether movement is acceptable.
B. Evaluate excavation influence, support or underpinning needs, and monitoring before removing soil that supports the existing foundation.
C. Assume the neighboring foundation is unaffected because it is on a separate property.

D. Reduce construction documentation so the contractor can react informally in the field.

47. During steel erection, the permanent lateral system will not be complete for several sequences. Which approach best addresses stability of the partially erected frame?

A. Remove temporary bracing as soon as any two beams are connected.

B. Rely on member self-weight to stabilize the incomplete frame against all lateral effects.

C. Assume the final structural analysis automatically proves every intermediate erection stage stable.

D. Provide and maintain the required temporary bracing until the permanent lateral system is complete and effective.

48. On a structural project, which statement most accurately distinguishes a shop drawing submittal from a request for information?

A. A shop drawing shows proposed fabrication or installation details, while an RFI asks for clarification of information needed to proceed.

B. A shop drawing changes the design automatically, while an RFI never affects project decisions.

C. An RFI is a fabrication drawing, while a shop drawing is used only for payment documentation.

D. Both documents transfer the engineer's design responsibility to the contractor once submitted.

49. For normal-weight concrete, use Ec = 57,000 sqrt(f'c) psi. If f'c = 4,500 psi, what modulus Ec results?

A. 2,419 ksi

B. 7,637 ksi

C. 60,463 ksi

D. 3,824 ksi

50. For an elastic concrete member, which material property is used most directly to relate normal stress to normal strain in the initial approximately linear response range?

A. Modulus of elasticity.

B. Compressive strength alone.

C. Unit weight alone.

D. Air content alone.

51. A reinforced concrete section contains seven No. 8 bars, each with area 0.79 in2. What total reinforcing area is provided?

A. 4.61 in2

B. 5.53 in2

C. 6.45 in2

D. 0.92 in2

52. Which statement most accurately describes the difference between structural-steel yield strength and ultimate tensile strength?

A. Yield strength is always greater than tensile strength for ductile structural steel.

B. Tensile strength is the elastic modulus measured before any yielding occurs.

C. Yield strength marks significant permanent deformation; tensile strength is the maximum engineering stress reached in tension.

D. The two terms are interchangeable because both describe only stiffness.

53. A steel coupon has axial stress of 20 ksi and corresponding elastic strain of 0.00062. What modulus E is indicated by E = stress/strain?

A. 32,258 ksi

B. 12,400 ksi

C. 20 ksi

D. 0 ksi

54. Why do structural design values for wood distinguish loading parallel to grain from loading perpendicular to grain?

A. Wood is isotropic, but design tables intentionally create artificial directional differences.

B. Moisture content eliminates all directional behavior once lumber is dried.

C. Its cellular structure makes it orthotropic, so stiffness and strength depend strongly on loading direction relative to grain.

D. Only connection design depends on grain direction; member strength does not.

55. When masonry prisms are tested in compression, which design-related material property is the test intended to characterize most directly?

A. Yield strength of reinforcing steel.

B. Compressive strength of the assembled masonry system.

C. Elastic modulus of structural steel.

D. Moisture content of timber framing.

56. A soil has porosity n = 0.36. What is its void ratio e = n/(1-n)?

A. 0.337

B. 1.264

C. 0.202

D. 0.562

57. A soil sample has total weight 126 lb and total volume 1.50 ft3. What is its total unit weight?

A. 188.9 pcf

B. 63.0 pcf

C. 125.9 pcf

D. 84.0 pcf

58. For a soil bearing estimate, use qult = gamma Df Nq. If gamma = 120 pcf, Df = 4 ft, and Nq = 20, what ultimate bearing pressure results?

A. 2,400 psf
B. 4,800 psf
C. 9,600 psf
D. 43,200 psf

59. Which laboratory procedure is used most directly to establish the compressive strength of a conventional molded concrete cylinder?

A. Axial compression to failure in a testing machine.
B. Charpy impact testing with a notched specimen.
C. Direct tension testing of a steel coupon.
D. Sieve analysis of the hardened cylinder.

60. A steel specification requires a Charpy V-notch test. Which aspect of material behavior is that test intended to evaluate most directly?

A. Concrete compressive strength.
B. Impact toughness and sensitivity to brittle fracture behavior.
C. Soil permeability under hydraulic gradient.
D. Masonry prism compressive strength.

61. In a reinforced CMU wall, grout is placed in cells containing vertical reinforcing bars. What is the principal structural reason for the grout?

A. Replace all mortar joints between masonry units.
B. Fill reinforced cells so the bars and masonry can act together and transfer forces.
C. Prevent reinforcing steel from carrying any tension.
D. Serve only as architectural finish material on exposed faces.

62. What is the principal service-performance advantage gained by prestressing a concrete member before most service loading is applied?

A. It eliminates all concrete compression under service loads.

B. It makes reinforcing or prestressing steel unnecessary in every member.

C. It introduces beneficial compression that can reduce service-load tensile stress and cracking.

D. It guarantees zero deflection regardless of span and loading.

63. A singly reinforced rectangular concrete beam has b = 12 in., d = 20 in., As = 3.4 in2, fy = 60 ksi, and f'c = 4 ksi. Using a = As fy/(0.85 f'c b) and Mn = As fy(d-a/2), what is Mn?

A. 357.0 kip-ft

B. 148.8 kip-ft

C. 334.4 kip-ft

D. 297.5 kip-ft

64. For a concrete beam with nominal flexural strength Mn = 335 kip-ft, use phi = 0.90. What design flexural strength phiMn is available?

A. 301.5 kip-ft

B. 335 kip-ft

C. 371.7 kip-ft

D. 268 kip-ft

65. For a reinforced concrete beam, use Vc = 2 sqrt(f'c) bwd in pounds. If f'c = 4,000 psi, bw = 12 in., and d = 20 in., what Vc results?

A. 15.3 kip

B. 30.4 kip

C. 60.8 kip

D. 5.1 kip

66. For this practice check, required development length is defined as ld = fy db/(25 sqrt(f'c)). Use fy = 60,000 psi, db = 0.875 in., and f'c = 4,000 psi. What ld results?

A. 16.6 in.

B. 66.5 in.

C. 13.3 in.

D. 33.2 in.

67. A tied concrete column has Ag = 156 in2 and Ast = 8 in2. For this problem use Pn = 0.85 f'c(Ag-Ast) + fyAst with f'c = 5 ksi and fy = 60 ksi. What is Pn?

A. 606 kip

B. 1,612 kip

C. 1,109 kip

D. 949 kip

68. A one-way slab strip is idealized as a simply supported 12-ft span carrying 0.52 kip/ft. Using Mmax = wL^2/8, what strip moment results?

A. 9.36 kip-ft

B. 4.68 kip-ft

C. 18.72 kip-ft

D. 74.88 kip-ft

69. A nearly square reinforced-concrete floor panel is supported along all four edges. Which response most clearly indicates two-way slab behavior?

A. The slab distributes significant bending and load to supports in both orthogonal directions.

B. The slab carries all load only to the two supports along its short edges.

C. The slab carries only axial compression with no flexural action.

D. The slab transfers load directly to columns without any plate action.

70. A square footing is 8 ft by 8 ft and supports a concentric service load of 384 kip. Neglect footing weight. What average soil bearing pressure is produced?

A. 48 ksf
B. 3 ksf
C. 6 ksf
D. 76.80 ksf

71. A 10-ft-wide footing carries P = 540 kip with eccentricity e = 0.50 ft about the footing centerline. For a one-foot strip, use qmax = (P/A)(1 + 6e/B), with A = 10 ft2. What is qmax?

A. 54 ksf
B. 70.20 ksf
C. 86.40 ksf
D. 37.80 ksf

72. A pile group contains six piles, each with allowable axial capacity 95 kip. If a stated group-efficiency factor of 0.85 applies, what allowable group capacity is used?

A. 570 kip
B. 80.75 kip
C. 670.3 kip
D. 484.5 kip

73. A retaining wall experiences a triangular lateral soil resultant of 21 kip/ft acting at H/3 above the base, where H = 12 ft. What overturning moment about the toe is caused by this soil force?

A. 252 kip-ft/ft
B. 84 kip-ft/ft
C. 63 kip-ft/ft
D. 7 kip-ft/ft

74. A retaining wall has total stabilizing vertical load W = 84 kip/ft, base friction coefficient mu = 0.50, and horizontal driving force P = 20 kip/ft. Using FS = muW/P, what sliding factor of safety results?

A. 4.20

B. 1.05

C. 2.10

D. 0.5250

75. A compact steel beam has Fy = 50 ksi and plastic section modulus Zx = 132 in3. For this practice check, take nominal plastic moment Mn = FyZx. What is Mn?

A. 6,600 kip-ft

B. 275 kip-ft

C. 1,100 kip-ft

D. 550 kip-ft

76. A long steel beam has adequate cross-sectional flexural strength but little lateral restraint to its compression flange. Why can its usable bending strength still be reduced?

A. The compression flange can move laterally and twist the member, producing lateral-torsional buckling before full flexural strength develops.

B. Lateral bracing increases steel yield strength by changing the material chemistry.

C. Without bracing, the beam carries only axial load and no bending moment.

D. Lateral bracing is relevant only to concrete beams, not structural steel.

77. A steel tension member has gross area Ag = 9.0 in2 and Fy = 50 ksi. Using phi = 0.90 and design yielding strength phiFyAg, what strength results?

A. 450 kip

B. 405 kip

C. 360 kip

D. 499.5 kip

78. A steel tension member has effective net area Ae = 6.1 in2 and Fu = 65 ksi. For this problem use phi = 0.75 for net-section rupture. What design rupture strength results?

A. 297.4 kip
B. 396.6 kip
C. 228.8 kip
D. 540.8 kip

79. A connection uses four bolts, each with stated design shear strength of 31 kip, and the load is shared equally. What total design shear strength is available?

A. 31 kip
B. 62 kip
C. 124 kip
D. 93 kip

80. For a fillet weld, use design strength phiRn = phi(0.6Fexx)(0.707wL). With phi = 0.75, Fexx = 70 ksi, weld size w = 0.30 in., and length L = 10 in., what strength results?

A. 89.0 kip
B. 133.6 kip
C. 47.3 kip
D. 66.8 kip

81. A steel column has E = 29,000 ksi, I = 520 in4, effective length KL = 180 in. Using Euler Pcr = pi^2EI/(KL)^2, what critical load results?

A. 9,188 kip
B. 2,297 kip
C. 4,594 kip
D. 382 kip

82. A member interaction check is defined as Pu/phiPn + Mu/phiMn <= 1.0. If Pu = 210 kip, phiPn = 600 kip, Mu = 90 kip-ft, and phiMn = 150 kip-ft, what interaction ratio results?

A. 0.32
B. 0.95
C. 0.63
D. 1.58

83. In a composite floor beam, headed studs connect the concrete slab to the supporting steel beam. What is their primary structural function?

A. Transfer longitudinal interface shear so the slab and steel beam can act compositely in flexure.
B. Prevent all vertical shear from entering the steel web.
C. Increase the concrete compressive strength by chemical treatment.
D. Eliminate the need for any flexural reinforcement or steel section.

84. A timber beam has allowable bending stress Fb = 1.35 ksi and section modulus S = 180 in3. What allowable bending moment is FbS?

A. 243 kip-ft
B. 10.13 kip-ft
C. 40.50 kip-ft
D. 20.25 kip-ft

85. A timber post carries 48 kip through a gross area of 36 in2. What average compressive stress acts on the section?

A. 1.33 ksi
B. 0.97 ksi
C. 17.16 ksi
D. 47.74 ksi

86. A wood connection requires 22 kip of design lateral resistance. Each fastener provides 4.5 kip of stated design resistance, and load sharing is equal. What minimum number of fasteners is required?

A. 4 fasteners
B. 5 fasteners
C. 6 fasteners
D. 7 fasteners

87. A masonry wall carries a concentric axial load of 78 kip over a net area of 120 in2. What average compressive stress is produced?

A. 65.00 ksi
B. 0.18 ksi
C. 1.30 ksi
D. 0.65 ksi

88. A masonry shear wall segment carries V = 54 kip. Using average shear stress v = V/(bd) with b = 8 in. and d = 120 in., what average shear stress results?

A. 0.448 ksi
B. 0.006 ksi
C. 0.056 ksi
D. 5.600 ksi

89. A diaphragm develops an in-plane bending moment of 660 kip-ft between its chord lines, which are 30 ft apart. Using chord force F = M/d, what chord force magnitude is required?

A. 19,800 kip
B. 22 kip
C. 11 kip
D. 33 kip

90. Within a diaphragm load path, what is the primary function of a collector, sometimes called a drag strut?

A. Support only gravity loads from floor finishes.

B. Reduce the material yield strength so seismic forces are smaller.

C. Collect diaphragm forces and deliver them to the vertical lateral-force-resisting system where direct transfer is discontinuous.

D. Replace every diaphragm chord and boundary element in the structure.

91. A chevron bracing bay has two identical braces at 45 degrees to the horizontal. If a 110-kip story shear is shared equally through the horizontal components of the two braces, what axial force acts in each brace?

A. 77.8 kip

B. 55.0 kip

C. 110.0 kip

D. 155.6 kip

92. A lateral frame resists an overturning moment of 1,320 kip-ft through a tension-compression couple separated by 24 ft. What axial force magnitude is required in each side of the couple?

A. 110 kip

B. 31.68 kip

C. 1,320 kip

D. 55 kip

93. A steel column transfers 460 kip concentrically through a 14 in. by 18 in. base plate. What average bearing pressure acts beneath the plate?

A. 1.83 ksi

B. 25.53 ksi

C. 32.87 ksi

D. 0.66 ksi

94. A base connection resists a 270 kip-ft moment using a tension-compression couple with 20 in. between the force resultants. Neglect axial load. What force magnitude is required in the tension anchor group?

A. 13.50 kip
B. 270 kip
C. 162 kip
D. 324 kip

95. A footing has width B = 8 ft and load eccentricity e = 0.65 ft. Using the effective-width approximation B' = B - 2e, what effective width results?

A. 7.47 ft
B. 6.70 ft
C. 5.15 ft
D. 9.02 ft

96. A rigid pile cap carries a concentric 540-kip vertical load supported by four identical piles with equal stiffness. Neglect cap weight and group effects. What axial load is assigned to each pile?

A. 540 kip
B. 270 kip
C. 67.50 kip
D. 135 kip

97. A drilled shaft has diameter 4 ft, embedded length 32 ft, and uniform unit side resistance fs = 0.60 ksf. Using Qs = perimeter x length x fs, what side resistance results?

A. 76.8 kip

B. 482.6 kip

C. 241.3 kip

D. 120.7 kip

98. A 12-ft-wide retaining-wall base carries a resultant vertical load P = 270 kip/ft with eccentricity e = 1.0 ft. Using qmax = P/B(1 + 6e/B), what maximum base pressure results?

A. 22.50 ksf

B. 33.75 ksf

C. 11.25 ksf

D. 45 ksf

99. What structural functions are provided by ties or spiral reinforcement surrounding the longitudinal bars in a reinforced-concrete column?

A. They restrain longitudinal-bar buckling, confine the core, and help maintain the intended reinforcement cage and shear resistance.

B. They replace all longitudinal reinforcement under axial load.

C. They eliminate concrete cracking and crushing under every load combination.

D. They are used only to support formwork and have no structural function after curing.

100. Which connection-design philosophy most directly supports ductile behavior when a structural system is expected to undergo significant inelastic lateral response?

A. Make the most brittle component intentionally weaker so it fails first.

B. Eliminate deformation capacity by maximizing connection stiffness regardless of load path.

C. Rely on field welding alone without verifying force transfer through the connected elements.

D. Provide a clear yielding mechanism while proportioning surrounding connection components to avoid premature brittle failure.

Practice Exam 25: Answer Key and Explanations

1. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 920 lb/ft, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

2. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 26.4 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

3. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 75 psf, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

4. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 146.4 psf, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

5. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 26.6 psf, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

6. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 30.3 psf, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

7. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 221 kip, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

8. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 2,138.4 lb/ft, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

9. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 3,528 lb/ft, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

10. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 22 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

11. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 3.50 kip/ft, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

12. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 63.4 psf, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

13. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 40 psf, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

14. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 33.8 psf, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

15. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 70 kip, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

16. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 129 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

17. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 131 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

18. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 90 kip-ft, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

19. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 93.15 kip-ft, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

20. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 24 kip, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

21. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 22 ksi, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

22. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.1192 in., which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

23. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 735 in3, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

24. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 2.2 ksi, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

25. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.031 in., which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

26. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.0112 in., which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

27. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 8,127 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

28. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 11.54 ksi, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

29. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 18 ksi, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

30. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 23.8 ksi, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

31. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.1685 in., which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

32. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 10.93 ksi, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

33. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 66 kip-ft, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

34. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.0366 in., which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

35. D — Joint equilibrium requires the vector sum of member forces to be zero. With only two non-collinear member directions and no external load or support reaction at the joint, the only solution is zero force in both members. Equal nonzero forces cannot cancel unless the members are collinear, so the geometric condition is essential.

36. A — A fixed-fixed beam has more reaction components than can be solved using planar equilibrium alone, so compatibility and stiffness relationships are required. A conventional pin-roller simple beam and a cantilever are externally determinate, while a stable basic triangular truss can be solved by equilibrium when its support and member arrangement is determinate.

37. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 16.80 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

38. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 27 ksi, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

39. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 48 ksi, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

40. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 12.60 ksi, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

41. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 10,648 in4, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

42. D — Reshoring provides an intentional temporary load path so construction loads are shared by floors and supports while recently cast slabs continue gaining strength. It does not replace permanent columns, change concrete material strength directly, or remove the need for sequence analysis. The engineer must consider timing, stiffness, load redistribution, and removal sequence.

43. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 33,600 lb, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

44. A — Scaffold capacity must be matched to the actual intended loading and configuration before use. Workers, tools, stored materials, access loads, bracing, support conditions, and erection details can all affect demand and stability. Loading first and observing deflection is not a design check, and a temporary platform cannot be assumed equivalent to the permanent structure.

45. C — Special inspection provides targeted observation or testing of work identified by the applicable requirements and approved documents. It creates an independent record of whether specified materials and installation conditions conform. It does not transfer construction means-and-methods responsibility, authorize informal changes, or guarantee perfection. Nonconforming observations should be documented and resolved through the project process.

46. B — Removing soil near an existing footing can reduce confinement or support and may cause settlement, lateral movement, or instability. The risk should be evaluated before excavation, with underpinning, shoring, sequencing, and monitoring considered as needed. Waiting for movement to occur is reactive, and property boundaries do not interrupt the geotechnical or structural influence zone.

47. D — An incomplete frame may not yet have the diaphragms, connections, or lateral-force-resisting system assumed in the final design. Temporary bracing must therefore provide a stable load path during erection and remain until the permanent system can perform that function. Final-state adequacy alone does not demonstrate stability for every intermediate construction configuration.

48. A — Shop drawings communicate how specific items are proposed to be fabricated, assembled, or installed. An RFI is a question seeking clarification where the contract information is incomplete, conflicting, or uncertain. Neither document automatically transfers design responsibility or authorizes every change. Responses and reviews should remain consistent with the project roles and approved change process.

49. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 3,824 ksi, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

50. A — The modulus of elasticity relates stress to elastic strain and therefore controls predicted elastic shortening and deflection when a linear relationship is assumed. Compressive strength is a strength measure, unit weight affects loads, and air content influences durability and other properties. Those quantities may correlate with stiffness, but they are not the direct slope parameter.

51. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 5.53 in2, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

52. C — Yield strength identifies the stress level associated with the beginning of substantial inelastic behavior, while tensile strength is the peak engineering stress attained before necking and fracture progression. Elastic modulus instead describes stiffness. For typical ductile structural steels, tensile strength exceeds yield strength, so treating the two as interchangeable would distort strength and ductility checks.

53. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 32,258 ksi, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

54. C — Wood's cellular structure is strongly directional. Fibers carry loads efficiently along the grain, while transverse behavior depends on weaker cell-wall and bonding mechanisms. That makes stiffness, compression, tension, and connection behavior direction dependent. Drying changes moisture-related

properties but does not make wood isotropic, so grain orientation remains central to member and connection design.

55. B — A masonry prism contains masonry units and mortar arranged to represent the constructed assemblage, and compression testing provides a measure of masonry compressive strength. It does not test reinforcing-steel yield strength, structural-steel stiffness, or timber moisture. Using assemblage testing recognizes that unit, mortar, workmanship, and geometry together influence masonry behavior.

56. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.562, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

57. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 84.0 pcf, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

58. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 9,600 psf, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

59. A — Concrete cylinder compressive strength is obtained by loading the prepared specimen axially in compression and relating the maximum load to its cross-sectional area. Charpy testing evaluates impact toughness of metals, steel coupon tension tests metal stress-strain behavior, and sieve analysis characterizes particle-size distribution rather than hardened concrete compressive capacity. For

60. B — The Charpy V-notch test measures the energy absorbed by a notched metal specimen during impact and is commonly used to assess toughness and brittle-fracture susceptibility. It is not a concrete compression, soil permeability, or masonry prism test. The notch and impact loading intentionally create a demanding fracture condition rather than a simple static strength measurement.

61. B — Grout fills designated masonry cells and surrounds reinforcement, providing contact and force transfer so the reinforced masonry can act as an integrated structural element. It does not replace bed and head joint mortar, eliminate tensile demand in reinforcement, or function merely as a finish. Proper placement and consolidation are important to achieving the intended load path.

62. C — Prestressing applies an initial compressive force and often an eccentric moment that counteracts tensile stresses produced by service loading. This can control cracking and improve serviceability for longer spans. It does not eliminate concrete compression, remove the need for steel, or guarantee zero deflection; time-dependent losses and load effects still require evaluation.

63. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 297.5 kip-ft, which corresponds to option D. The

distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

64. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 301.5 kip-ft, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

65. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 30.4 kip, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

66. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 33.2 in., which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

67. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 1,109 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

68. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 9.36 kip-ft, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

69. A — Two-way action occurs when plate bending in both principal directions contributes materially to load transfer. Comparable spans and support on four sides make that behavior plausible. A one-way idealization sends load mainly across one span direction. Slabs still develop flexure, and direct column transfer does not eliminate plate action between supports.

70. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 6 ksf, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

71. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 70.20 ksf, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

72. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 484.5 kip, which corresponds to option D. The distractors

represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

73. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 84 kip-ft/ft, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

74. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 2.10, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

75. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 550 kip-ft, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

76. A — A beam in major-axis flexure has a compression region that may buckle laterally while the section twists. Adequate bracing restrains this lateral-torsional mode and permits greater flexural resistance. Bracing does not change steel material yield strength, eliminate bending, or apply only to concrete. Stability and cross-sectional strength are separate design considerations.

77. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 405 kip, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

78. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 297.4 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

79. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 124 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

80. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 66.8 kip, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

81. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 4,594 kip, which corresponds to option C. The distractors

represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

82. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.95, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

83. A — Composite action requires the steel beam and concrete slab to develop compatible longitudinal deformation rather than freely slip at their interface. Shear connectors transfer the interface forces that make this possible. They do not remove all web shear, change concrete chemistry, or eliminate the need for the participating structural components and their required checks.

84. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 20.25 kip-ft, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

85. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 1.33 ksi, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

86. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 5 fasteners, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

87. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.65 ksi, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

88. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 0.056 ksi, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

89. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 22 kip, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

90. C — Collectors provide a deliberate in-plane load path from distributed diaphragm forces to shear walls, braced frames, or moment frames, especially where those elements do not align continuously with

the diaphragm edge. They are not merely gravity members, do not change material strength, and do not automatically replace chords or other boundary-force components.

91. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 77.8 kip, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

92. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 55 kip, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

93. A — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 1.83 ksi, which corresponds to option A. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

94. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 162 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

95. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 6.70 ft, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

96. D — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 135 kip, which corresponds to option D. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

97. C — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 241.3 kip, which corresponds to option C. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

98. B — Start from the relationship stated in the stem, substitute the given values, and keep the units consistent throughout. The resulting value is 33.75 ksf, which corresponds to option B. The distractors represent common mistakes such as omitting a conversion, halving or doubling a load effect, or misapplying a coefficient. Checking dimensions and expected magnitude confirms the result.

99. A — Transverse reinforcement performs several structural functions: it restrains longitudinal bars against local buckling, confines the concrete core, helps resist shear where applicable, and holds the

cage in position. It does not replace longitudinal steel, prevent every form of concrete damage, or become structurally irrelevant after the concrete hardens. Foundation and

100. D — Ductile design seeks controlled inelastic deformation in intended yielding regions while protecting brittle or low-ductility failure modes such as fracture, pullout, or abrupt connection rupture. That requires a clear load path and capacity hierarchy. Simply maximizing stiffness or allowing a brittle component to fail first undermines the desired energy-dissipating mechanism.